METHODS AND SYSTEMS FOR IMPROVED ABNORMALITY DETECTION IN MEDICAL IMAGING DATA

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This patent application claims priority to European Patent Application No. 20167487.6, filed Apr. 1, 2020, which is incorporated herein by reference in its entirety.

BACKGROUND

Technical Field

[0002] The present disclosure relates to methods for training an artificial intelligence entity, AIE, for detecting abnormalities such as lesions in medical imaging data of a human organ, in particular a prostate. Moreover, the disclosure relates to methods for detecting abnormalities in such medical imaging data, in particular using an artificial intelligence entity, AIE. The disclosure also relates to devices for detecting abnormalities in such medical imaging data.

Related Art

[0003] Imaging techniques such as magnetic resonance imaging, MRI, computed tomography, CT, and so on are more and more used for diagnostic tasks. Different imaging techniques are differently suitable for imaging different organs so that often for one type of organ one type of imaging technique is dominant, i.e. is predominantly used and/or is best used for diagnostics.

[0004] Some organs, in particular the human prostate, have different regions which respond differently to different medical imaging techniques. For example, a human prostate is divided into, among others, a peripheral zone, PZ, and a transition zone, TZ. The transition zone, TZ, surrounds the prostatic urethra and enlarges in aging men as a result of benign prostatic hyperplasia. The peripheral zone, PZ, is situated on the posterior and lateral side of the prostate, surrounding the transition zone.

[0005] Medical imaging techniques for detecting lesions within the prostate are usually different types (or: series) of MRI (Magnetic Resonance Imaging) scans. For the prostate, typical MRI scans comprise T2-weighted MRI scans (T2W), diffusion-weighted imaging (DWI) and dynamic contrast-enhanced (DCE) imaging. These types of MRI scans, in particular the first two, are also used in the PI-RADS assessment categories. Whenever PI-RADS is mentioned herein, it is referred to the "Prostate Cancer—PI-RADS v2" document by Rhiannon van Loenhout, Frank Zijta, Robin Smithuis and Ivo Schoots, publication date 2018-08-01, available e.g. at the URL: http://radiologyassitant.nl/abdomen/prostate-cancer-pi-rads-v2 . However, it shall be understood that also future version of PI-RADS may be similarly applied.

[0006] A combination of the results of multiple types of MRI scans is sometimes designated as a "multiparametric MRI", wherein "multiparametric" refers to the different parameter settings with which the respective MRI scan is performed. PI-RADS, for example, designates a combination of T2-weighted, diffusion weighted and dynamic contrast-enhanced imaging as a "multiparametric MRI". Based on the results of multiparametric MRIs, PI-RADS assessment categories are based which are used for standardized acquisition, interpretation and reporting of prostate MRIs. The PI-RADS categories range from "PI-RADS 1" (very low—clinically significant cancer highly unlikely) to "PI-RADS 5" (clinically significant cancer highly likely), wherein a clinically significant prostate cancer is defined as a tumor with a Gleason score of 7 or more.

[0007] T2W imaging is the primary determining sequence (i.e. scan) to assign the PI-RADS category in the transition zone, TZ. On the other hand, diffusion-weighted imaging (in particular DWI ADC) is the primary determining sequence to assign the PI-RADS assessment category for the peripheral zone, PZ.

[0008] In the international publication WO 2019/238804 A1, various advantageous methods and variants for detecting and localizing abnormalities in medical images are described.

[0009] However, hitherto known attempts of employing deep learning for organs that happen to comprise different spatial regions (e.g. transition zone, TZ and peripheral zone, PZ, in case of the prostate) responding differently to different types of medical imaging scans neglect information about these different spatial regions.

BRIEF DESCRIPTION OF THE DRAWINGS/FIGURES

[0010] The accompanying drawings, which are incorporated herein and form a part of the specification, illustrate the embodiments of the present disclosure and, together with the description, further serve to explain the principles of the embodiments and to enable a person skilled in the pertinent art to make and use the embodiments.

[0011] FIG. **1** shows a schematic flow diagram illustrating a method for training an artificial intelligence entity according to an exemplary embodiment;

[0012] FIG. **2** schematically illustrates the steps of the method of FIG. **1** according to an exemplary embodiment;

[0013] FIG. **3** shows a schematic flow diagram illustrating a method for detecting abnormalities within medical imaging data according to an exemplary embodiment;

[0014] FIG. **4** schematically illustrates the steps of the method of FIG. **3** according to an exemplary embodiment;

[0015] FIG. **5** shows a schematic flow diagram illustrating a method for training an artificial intelligence entity according to an exemplary embodiment;

[0016] FIG. **6** schematically illustrates the steps of the method of FIG. **5** according to an exemplary embodiment;

[0017] FIG. **7** shows a schematic flow diagram illustrating another method for detecting abnormalities within medical imaging data according to an exemplary embodiment;

[0018] FIG. **8** shows a schematic block diagram illustrating a system according to an exemplary embodiment;

[0019] FIG. **9** shows a schematic block diagram illustrating a system according to an exemplary embodiment;

[0020] FIG. **10** shows a schematic block diagram illustrating a computer program according to an exemplary embodiment; and

[0021] FIG. **11** shows a schematic block diagram illustrating a data storage medium according to an exemplary embodiment.

[0022] The exemplary embodiments of the present disclosure will be described with reference to the accompanying drawings. Elements, features and components that are identical, functionally identical and have the same effect are—